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The Global History of Techniques and the Globalization of the History of Techniques

Guillaume Carnino, Liliane Hilaire-Pérez, Jérôme Lamy

In this article, we propose to revisit some of the salient features of the collective work we recently directed, *Global History of Technics, 19th-21st Century* (Hilaire-Pérez, Carnino, Lamy, 2024). The aim is to outline the epistemological stances we have taken and to present some of the concrete results discussed in the book.

Far from painting a simplified picture of evolutions on a global scale, we have chosen to open with a world tour of techniques in a bid to restore the complexity of regional historiographies and of the meanings given to technical activities in society. This approach seems particularly necessary considering the return of grand narratives which, in the name of global history, fall back on the mostly Eurocentric meta-narrative that long dominated this field of research as we have argued together with other historians since a few years (Berg, 2013; Bray, 2015; Bray, Hilaire-Pérez, 2016; Popplow, 2016).

We will first focus on two essential points regarding our approach. First, in the initial section, we will discuss our choice to focus on technique rather than technology – this decision is not merely semantic but reflects a particular vision of history. Then, in the second section, we will detail the reasons that led us to prefer a decentralized history, moving away from somewhat futile attempts at the "Big Picture". These two shifts form the anchors for a series of syntheses that emphasize approaches based on geographical areas, objects and processes, and connections between activities involving techniques. Thus, in the third section, we will discuss some of these cases to concretely illustrate our approach.

Techniques more than technology

Part and parcel of our decentred vision is our use of the terms 'technique' and 'technology'. While 'technology' has become ubiquitous on a global scale and somewhat emphatically refers to the advanced technological productions of industrial societies ('new technologies') as opposed to traditional techniques, this meaning is rather ambiguous, and the term actually polysemic. For a long time, the term 'technology' did signify the science of technique (*techno-logos*), the science of the arts and of manufacture; in 1728 Christian Wolff defined *technologia* as 'the science of the arts and works of art, the science of things that men produce by the work of organs of the body, mainly by the hands', and in 1806 Johann Beckmann stated the same in his *Entwurf der allgemeinen Technologie* or 'General Project of Technology' (Carnino, Hilaire-Pérez, Hooock, 2017). This sense of the concept of technology, which opened up the possibility of a science of human activity and was marked both by encyclopaedism and the political issues of different states' efficient management of resources, faded during the nineteenth century, when the science of engineers, process engineering, and the acceptance of technology as an applied science emerged (Schatzberg, 2006, 2018). Technology then no longer referred to the reasoned and comparative study of the means of production, but rather to the industrial operation of transforming materials into products. The former, more reflexive meaning was henceforth only used in the small, yet active, circles of collection curators, philosophers, anthropologists, and ethnologists who argue in favour have seeing 'technology as a human science' (Haudricourt, 1987) and contributed to its reappearance as a field of study in the social sciences (Iribarren, 2021; Loeve, Deldicque, 2018).

The way the field has developed raises a number of issues, including that of the term 'technique', which has almost disappeared from the English language in favour of the term 'technology'. While the history of technology is increasingly globalized, its research

community is increasingly international. English being the *lingua franca* of modern globalization as well as the language of historians of globalization, the use of the term 'technology' has also increased, as John Krige (Krige, 2019: 15) has pointed out. This raises further questions and invites critical reflection, as the term 'technology' is associated with western techniques understood to be applications of science, or at best techno-scientific hybrids, that helped the economic growth that characterized this part of the globe from the eighteenth century onwards. As Mikael Hård explains, historians generally follow 'the common understanding of technology as more akin to engineering than to material culture. For example, the hydropower plant, in its close association to the field of engineering, is more likely to be understood as an artefact of technology than, say, bows and arrows' (Hård, 2017). Faced with the limits of the term 'technology', which fails to capture techniques outside the scientific field and, as was the case for many centuries and many regions of the world, created the myth of a 'technological vacuum' in some places or time periods, some historians have resorted to reconnecting history of technology with "material culture" (Hård, 2023). As we express in a recent issue, "recent studies of materiality expand the understanding of technology to include the diversity and sophistication of techniques, which has long been a resource for societies to cope with constraints and to devise artefacts adapted to their needs and serving their ambitions" (Gerritsen, Hilaire-Pérez, Riello, 2024, 16). Other historians have attempted to forge new words and concepts, like 'useful knowledge' or 'useful and reliable knowledge', to restore cultures to their appropriate know-how, skills, and technological knowledge (Mokyr, 2002; Berg, 2007; O'Brien, 2019), while pointing to the limitations of "usefulness" (Schafer and Valeriani, 2021). A third option has been to propose an examination of the meaning given to techniques in non-western cultures by looking at words used in different societies to refer to processes or aspects of human activity. For instance looking at the word 'way' used among the vaShona hunters of Zimbabwe to refer to a means of action and displacement (Mavhunga, 2014); or 'fundi' used in Kiswahili manuals in Tanzania to refer to a group of tasks ranging from divination, carpentry, and tailoring to playing soccer (Grace, 2021); or the use 'gong', as both an accounting unit for the task and a quantity of work in Song China (Lamouroux, 2010b) helps enrich the very notion of technique (Mavhunga, 2017; Coupaye, 2021).

Encouraged as we are by a historiography of techniques that has largely benefited from the contributions of the social sciences and that does not reduce techniques to efficiency, it seems important for us to maintain, and even extend, the use of the word 'technique' to refer to human activities and know-how, whether these activities use tools or not. Therefore, instead of "rehabilitating of technology" (Schatzberg, 2018, 235-236) or "reclaiming the term technology" as Hård advocates (Hård, 2023, 6-8), we prefer "the use of the noun *technique* where 'technology' no longer seems appropriate" (Camolezi, Hilaire-Pérez, 2024, 38). This position is in keeping with the modern emergence of the term 'technique', as an activity that is conceptually distinct. Socially and linguistically identified in France as '*la technique*' from the end of nineteenth century to the 1940s (Camolezi, 2021), it remained connected to other human activities and interests, hence philosophers and social scientists from Alfred Espinas to Marcel Mauss for instance understanding 'technical action as a social fact' (Iribarren, 2021). It is also in this sense that the term 'technic' is sometimes employed in recent historiography (Kumar, 2019). At the same time the words 'technique' and 'technical' have increasingly been used in English to describe method, skill, and know-how (Krige, 2019; Mateos, Suárez-Díaz, 2019).

We can then define 'technique' as a set of actions and processes and their cumulative material manifestation in objects produced by human beings. Technique acts as a key mediation between man and the world: in this sense, it is controlled and embodied by actions (e.g. know-how necessary to the handling of an object) while objects are informed by these actions (e.g. tools used whose very form is shaped by their use and transformed by

their wear and tear). This is what properly constitutes technique. The relationship between embodied knowledge and tools started when human beings first started using tools. It conditions and defines the relationship of humans to the world. It therefore deserves a dedicated term.

We think it is important to continue to be aware of ‘technology’ in the sense of the science of the arts, which was its meaning in French and in German in the nineteenth century. According to recent research, this meaning has persisted in different intellectual contexts which are now gradually being better identified. At the same time, there is currently research on the complexity of the long-term codification of techniques. This raises several issues, not least that of the interaction with tacit and localized knowledge including in recent times, despite the rejection of this tacit knowledge by forms of standardized knowledge and the automation of production (Le Roux, Guéritte, 2016; Carnino, Marquet, 2019). It is therefore also appropriate to consider ‘technology as a human science’ more closely, since our aim is to place technology back at the heart of intellectual history, an aspect that has long been neglected by historians who tend to reduce technology to instrumentation, applied or industrial science, and productivism.

What globality ?

The global logic is based on two rationales. On the one hand, it builds on research carried out internationally that rejects overarching diffusionist narratives in favour of an approach that stresses the complexity of how techniques circulate (Hilaire-Pérez, Verna, 2006; Krige, 2019), and more generally stresses the many forms of divergence that exist — what anthropologists call socialized technique and which economic historians are just beginning to consider (Davids, 2019). On the other hand, this book’s chapters contribute to asking new questions because of their self-critical approach (Lamy, 2018; Crépel, Lamy, Petitjean, 2017; Grunwald, 2018; Heßler, Weber, 2019; Böhn, Möser, 2010), their attention to terminology (Schatzberg, 2006, 2018; Carnino, Hilaire-Pérez, Hooek, 2017), to issues of scale, and because they highlight the complex role of various timescales on techniques (Grunwald, 2012; Benoit, 2020).

In line with current research, we adopt, a critical point of view on the history of techniques (Feenberg, 2004; Jarrige, 2014; Jasanoff, Kim, 2015; Hård, Jamison, 1998). As the authors of a dossier on infrastructures and their place in the ideologies of power and modernity put it,

While the Silicon Valley’s industrial, institutional and financial infrastructures are now a model that is spreading to many parts of the world, while so-called ‘Smart Cities’ are fashioning the deployment of new urban surveillance and control infrastructures, the humanities and social sciences cannot simply stand by and describe evolutions: they must also interrogate them and analyse the deeper ideological issues at work (Jarrige, Le Courant, Paloque-Bergès, 2018: 8).

This is also the approach of some authors who outline the hidden and paradoxical issues at stake in European technologies, including their vulnerabilities (van der Vleuten, Högselius, Hommels, Kaijser, 2013), and others who focus on the role played by ‘technocratic experts’, from engineers to economists, in the establishment of post-colonial hierarchies via asymmetrical technical transfers (Pretel, Camprubi, 2018b). This critical approach is particularly well represented in France in relation to the environmental impacts of technology (Bonneuil, Fressoz, 2016; Jarrige, Le Roux, 2017), to notions of risk and technical uncertainty (Fressoz, 2012; Fridenson, 2012; Le Roux, 2016), to those of breakdowns and

accidents (Lambert, Raveux, 2019) and to workers' opposition to machinism (Bourdeau, Jarrige, Vincent, 2006; Biagini, Carnino, 2015; Jarrige, 2014).

At the heart of these approaches is the paradigm of the construction of technopolitical regimes, an idea that underpins the global history of modern techniques and has dominated the literature for a generation (Winner, 1980; Noble, 1984; Hecht, 1998, 2012; Mitchell, 2011; Kurban, Peña-Lopez, Haberer 2017; Krige, 2019), inviting us to re-read transnational political processes - such as European integration for instance - in the light of the history of techniques—with the ideas of a 'hidden integration' and a 'hidden fragmentation' (Misa, Schot, 2005: 3). This political dimension was the focus of Larissa Zakharova's work on the global history of techniques, and it has largely inspired this book (Zakharova, 2020; Hilaire-Pérez, Zakharova, 2016). Going against any nationalistic appropriation of techniques, a tendency as potent in France as in the USSR, Larissa Zakharova showed that supposedly national techniques resulted in fact from multiple encounters that resulted in an 'interdependence of territories' – whether the latter be desired or imposed, embraced or negated (Hilaire-Pérez, Zakharova, 2016: 25) – and led to various forms of adaptation rather than any homogeneity (Zakharova, 2016, 2020). This book, therefore, seeks to understand and contextualize these nationalistic narratives in the light of a political history of techniques at the same time as it uncovers complex processes made up of hybridizations, multiple timescales, and territories, highlights polysemic notions and controversies. This calls for the adoption of a variety of points of view, methods, and conceptual tools.

We choose to highlight the diversity of reflections and conceptual tools at work. Several choices made for our book bear witness to specific points that we feel it is important to make. One of these is the relationship between techniques and globalization. At the beginning of the book we emphasize the multiple pitfalls that threaten any attempt to reconstruct a history spanning more than two centuries of technological practices on a global scale. One major focus is the definition of globalization itself. The term is often used as an alternative to such terms as 'connected', or 'transnational'. This is not merely a linguistic issue. Each term is connected to a historiographical project, so that clarity is important. David Edgerton defines globalization as a means of studying 'all places that use technology, not just the small number of places where invention and innovation is concentrated' (Edgerton, 2006: xiii). Focusing on the analysis of how technologies are used rather than invented, Edgerton calls for 'a history of technology engaged with all the world's population, a population, which is mostly poor, non-white, and half female' (Edgerton, 2006: xiii). Globalization here thus refers to an actual situation. Technology considered as techniques, that is as a means of acting on the world is therefore part of his analysis. In a way, this global history of material practices is based on a naturalization of diffusionism. The study of centres of technical production and innovation and how technologies circulated from these centres was at the core of traditional anthropology and prehistoric studies (Leroi-Gourhan, 1943, 1945; Haudricourt, 1987). The fact it echoes with current reflections on the globalization of techniques explains its recent revival (Gazagnadou, 2008). Due to the prevalence of information infrastructures (Mattelart, 1992, 1999) and very large-scale energy flows (Gras, 2015) in the contemporary period, among other things, globalization has been taken for granted as a key factor for the circulation and adaptation of techniques.

In contrast with this vision, we first need to remind ourselves that long-distance communications were used prior to the nineteenth century. It is also important to stress that the supposed fluidity of globalization processes is by no means obvious (Didry et al., 2004): issues linked to the (in)compatibility of various national norms (Méadel, 1994, path dependency (David, 1985; Gardey, 1998), various instances of resistance (Jarrige, 2014; Fischer, 2022), and state control of flows (Krige, 2019) all contradict such neat narratives of technologies smoothly spreading around the world.

The predominance of science (to the detriment of techniques) in the study of globalized forms of exchange and appropriation poses another difficulty that needs to be navigated. Asymmetry is not a new concept (Febvre, 1935), but it calls for increased vigilance here. In fact, recent attempts to develop a framework for the global history of science (which incidentally often includes techniques although this is not clearly stated) have led to the West being overvalued (Roberts, 2009) and techniques to be seen merely as components of scientific activity (Fan, 2012).

We use the term globalization in the sense of a relational capacity of individuals to produce, transmit, appropriate, transform, contest, and even ignore techniques. The large cultural areas defined in the first part of the book thus exemplify congregated coherent technological structures as well as areas of more or less stable technical exchanges. These divisions make it possible to identify different levels of appropriation, standardization, and circulation. These are by no means rigid structures limiting the possibilities of a multifaceted approach to the continuous mutation of technical appropriation.

Connected history, unlike comparative history, intends to focus on the social, political, and cultural processes where the 'local and specific' meets the 'supra-local' (Subrahmanyam, 1997: 745). One of the difficulties in discussing techniques lies in the material nature of the exchanges at stake. Roger Chartier asked with regard to this type of approach:

How can we think about the relationship between appropriation and acculturation, between inventive reuse and cultural uprooting? How can we define the processes of 'interaction' or 'negotiation' (...) depending on whether they operate within relations of domination or in relations of exchange? (Chartier, 2001: 123).

The quest for an illusory 'global' overarching template — a grand narrative accounting for the supposed formalization of techniques — is another major pitfall for any attempt at dealing with the history of techniques on a global scale. The period spanning the nineteenth, twentieth and twenty-first centuries has too narrowly been studied through a purely economic lens: industrial revolutions, the transformations of modern capitalism, the massive monetization of human activities and endeavours and since the 1970s, the deployment of a neoliberal programme supported by international institutions (IMF, World Bank) have resulted in a focus on economic models (Pretel, Camprubi, 2018a). From this perspective, techniques have been considered as a variable that can explain any increase in trade, the speed of communication, increased productivity, etc. (Verley, 1997). Taken for granted techniques are included in a purely economic narrative. However, some current studies attempt to disentangle the analysis of techniques from such a reductive economic understanding:

In the face of the often simplistic discourse that the spectacular transformations of present-day Chinese society give rise to, it seemed essential for us to recall that these have a history, a history during which the activity and technical knowledge that bring about change have never depended solely on economic conditions,

and techniques here cover

the unequal capacity of different groups and individuals to act on their environment and to legitimize this activity (Lamouroux, 2010a: 161).

Generally speaking, in response to the questions of 'who invented what' and which techniques may have generated increases in productivity, historians increasingly tend to examine the multiple issues related to techniques, their fitness to purpose, and their transmission in specific societies before embarking on large-scale comparisons and grand narratives of globalization.

The search for homogeneity in the history of technology also applies to attempts at model building like Immanuel Wallerstein's world-systems (Wallerstein, 2009). The multiple criteria used (economic, political, cultural, ideological, etc.) obfuscate the specific characteristics of technical practices so that it becomes impossible to identify them. On the

other end of the spectrum is the division of technical practices into a myriad of case studies (Douki, Minard, 2007: 18) that explain each process in all its finest detail, but do not attempt to define a more comprehensive intellectual framework that might account for the processes at work.

In order to overcome these various conundrums in the historiography of the globalization of techniques, we have chosen to focus on the processes of circulation, a position which means taking into account actors' situations and motivations, potential failures, intermediaries, while transport and communication infrastructures are put into context (Hilaire-Pérez, 2008). Even the most modern dematerialized data cannot be abstracted from stubborn materiality (Laumonier, 2019). Using circulation as a lens draws attention to a variety of operations: it allows for the debunking of apparently self-evident notions such as innovation (Sainsaulieu, Saint-Martin, 2015) and for the exploration of various facets of human activities to identify forms of technical appropriation. Connections and exchanges are studied along instances of miscommunication and of techniques failing to spread: techniques thus emerge as infinitely varied practices that are inseparable from global processes, be they political, cultural, economic, or social.

A Kaleidoscope of Cases

To give more substance to our argument, we will present three cases from the book that highlight significant features and specific issues for each section. By varying perspectives and angles, we aim to capture the fine grain of historical experiences associated with contemporary techniques. The goal, through these variations, is to account for a fundamental property of techniques: their ability to articulate numerous and diverse sectors of human activities. From political approaches to cultural frameworks, economic interests, or international tensions, techniques are always embedded in regimes of practices and actions that they equip and, in return, orient, qualify, and provide with a certain social and heuristic thickness.

To illustrate the importance of geographical zoning of techniques, we will take the example of Oceania, analyzed by Marie Durand (Durand, 2024). The historiographical challenges posed by the historical study of Oceanian techniques from the 19th to the 21st century are numerous: colonial approaches have long dominated, the insularity of the covered area resists broad historical generalizations, and the oldest anthropological investigations have ignored the recent and rapid transformations of Oceanian worlds. Despite these difficulties, Marie Durand proposes to study technical mutations in three sectors of human activity: transportation, resource exploitation, and communication.

The construction of canoes—crucial in an archipelagic space—mobilized numerous and varied technical skills in the 19th century (from hollowing out canoes to a fine knowledge of materials). The handling of these vessels relied on precise knowledge of weather conditions and ocean movements. The arrival of Western ships (coming mainly for seal and whale hunting) and the intensification of trade (especially in wood) multiplied opportunities for contact and exchange of objects. Oceanian practices transformed with the introduction of metal equipment. Simultaneously, exchange circuits changed, particularly because the construction of vessels evolved, with textile sails, the introduction of masts, and the use of hemp for ropes. The expansion of steam navigation reshaped exchange circuits and reconfigured the Oceanian economy. Indeed, maritime transport companies settled, taking advantage of colonial influence in the Pacific area.

With the beginning of the 20th century, it was not just maritime transport that evolved. The emergence of aerial transport (like aircraft) led to an exploratory phase in the discovery of Pacific territories during the 1920s. Subsequently, the regularity of air routes (notably from Australia to Papua New Guinea) reinforced the ongoing colonial process. Later, the generalization of jet propulsion reduced stopovers in the Pacific and refocused airlines in Australia and New Zealand.

The late 20th and early 21st centuries are marked by an effort to reintegrate the particularities of local techniques into the realm of possibilities. Thus, the construction of Polynesian vessels by indigenous populations has been revived.

Marie Durand discerns technical tensions in local resource exploitation that resonate with colonial practices. Indigenous mastery of agroforestry techniques (e.g., preserving tree trunks for soil fertilization) and the regulated, sparing use of botanical and zoological reserves created a form of balance linked to local power structures. The arrival of Westerners disrupted this state of affairs. Products like soap and candles, integrated into large-scale commerce, demanded the development of a coconut oil trade. From the 19th century, coconut trees, sugarcane, and cotton became primary resources exploited in Oceania. The 20th century added intensive extractivism (gold, nickel, copper), involving workforce displacement and factory construction, to this reconfiguration of agricultural techniques.

Regarding communications, Marie Durand highlights the deployment of submarine cabling technologies in the South Pacific. The efforts of colonial enterprises to network the area resulted in the introduction of telegraphy in Oceania. Subsequently, the spread of telephone networks further extended the reach of communication techniques. Radio exchanges (covered waves) began in the first half of the 20th century, and after World War II, radio technology saw significant growth. These communication techniques broadened and expanded certain local cultures: increased and longer-distance exchanges, for example, transformed ordinary rituals (like weddings) by the number of people informed and the gifts sent.

Marie Durand's synthesis of the evolution of techniques in Oceania precisely highlights the core epistemological aspect of our global approach. The numerous exchanges, colonial influences, and global technological deployments (such as communication) transform and reorganize local practices.

The second axis chosen to organize *Global History of Technics* concerns sectors of activities driven by or for specific techniques. From aeronautics to food production, from telecommunications to mining, the chosen perspectives are highly varied. Here, we present the synthesis by Elisabeth Mortier and Raphaël Morera on hydraulic techniques (Mortier, Morera, 2024). The authors emphasize from the outset the dual nature of devices associated with the circulation and distribution of water: their material grounding and their social and economic importance.

The 19th century was marked by the introduction of water as an essential product in industrial operations. The use of motor pumps enabled significant water captures. The invention of the water turbine in the 1830s placed hydraulic skills at the heart of the ongoing industrial transformations. The new use of concrete and rubber paved the way for a transformation in water supply systems. Simultaneously, water continued to be a means of energy production through hydroelectric techniques, which became dominant in the first half of the 20th century. Hydroelectric projects were not only markers of economic modernity but also political symbols (such as the Aswan High Dam in Egypt).

As a vital consumer product, water is integrated into numerous conservation, capture, and distribution devices: cisterns, galleries, fountains. Geological exploitation techniques were utilized in the 19th century to extract groundwater. Various drilling methods (such as percussion drilling or rotary drilling) supported a political and sanitary approach to water. The goal was to purify extracted water using techniques like ozonation. In the early 20th century, bleaching and chlorine usage took over.

Since water serves multiple purposes, its distribution circuits include its disposal and treatment. In France, starting from the Second Empire, lead pipes were used in sewers that gradually collected wastewater from homes. However, the sanitary treatment of this used water continued to be a political and urban issue. Filtering and purifying wastewater led to numerous technical proposals.

The vital nature of water, its highly diversified social appropriations, and the complex political architecture for its sharing and circulation explain why hydraulic techniques, in the broadest sense, have a strong political dimension.

The third part of the book examines how techniques have been intertwined with practices, structures, uses, choices, and political, economic, and cultural stakes. From training to Taylorism, from everyday objects to their repair, we aimed to show the technical embedding within the fabric of the social world.

Olof Hallonsten proposes a chapter on the transformations of Big Science. (Hallonstein, 2024) Born out of the Cold War, large-scale technical apparatuses for scientific research are characterized by the massive scale of the engaged devices as well as large-scale organizational modalities. As Olof Hallonsten points out, it is a "phenomenon of the Cold War." Political involvement in these large facilities is essential. The Manhattan Project, conceived in the United States to build an atomic bomb to gain a decisive advantage over Nazi Germany, was tied to specific political intentions.

Subsequently, during the Cold War, large scientific units multiplied, particularly in the field of physics. Supported by military funds, particle accelerators and nuclear reactors invigorated important sectors of scientific research. Particle physics, in particular, benefited from this highly favorable situation with the construction of large accelerators.

From the 1960s onwards, budgetary restrictions limited the technical gigantism of the equipment. Political protest and anti-militarism, which gained traction in the West, also contributed to a partial disqualification of these facilities supported by the "military-industrial-scientific complex." The economic crises of the 1970s imposed a diversification of the scientific sectors funded by governments. Particle physics was no longer the sole area of substantial investment. In the United States, particularly in the 1980s, accelerator projects were halted.

Particle physics gave way to "mega-sciences." Synchrotrons today serve numerous disciplines (materials science, biology, medicine, and even archaeology). Only CERN remains a large-scale particle accelerator dedicated to physics research in this domain. To describe Big Science today, Olof Hallonsten refers to it as "small science on big machines."

Identifying the different generations of installations (e.g., for synchrotron radiation sources) is a way to better understand the ongoing transformations in Big Science. Initially integrated into particle physics apparatuses, synchrotrons became specific equipment by the late 1970s (second generation). The third generation (in the 1980s) involved "insertion devices" for more intense radiation.

Overall, large scientific investigation facilities have developed through successive propagations, taking socio-economic contexts into account. The diversification of scholarly stakes and the transformations in political expectations have reconfigured the equipment towards plural uses, as in the case of the synchrotron.

With this example of Big Science, we can see how deeply technical transformations are embedded in complex frameworks that depend not only on developments specific to each discipline but also on considerations of the collectivization of these large-scale tools.

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The global history of techniques, as we have conceived it, owes nothing to the grand narrative of teleological and uniform development. It aims to provide a pluralistic perspective on complex processes, always interwoven within social, political, economic, and cultural contexts that both shape and are reshaped by these processes. It is thus essential to be attentive to the interpenetration of different technical logics during exchanges or colonial dominations (as we saw with Oceania). It is also crucial to consider the intersections between various sectors of the social order, all of which can be influenced by a technology. The case of water is exemplary in this regard: innovations, political projects, urban planning, public health monitoring, and social imperatives intersect and articulate to configure large hydraulic systems. The strength of a history of techniques approach that embraces the complexity and rejects simplistic narratives and monotonous logics lies in its ability to highlight complex sociotechnical phenomena. Thus, the transformations of Big Science under the triple constraint of epistemic, social, and budgetary evolutions reveal the plural logics of adapting technical expectations and offerings.

These have been the stakes of our book: to broadly open interpretative paths, vary intellectual frameworks, and diversify approaches to techniques by considering their deep insertion into the social order.

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